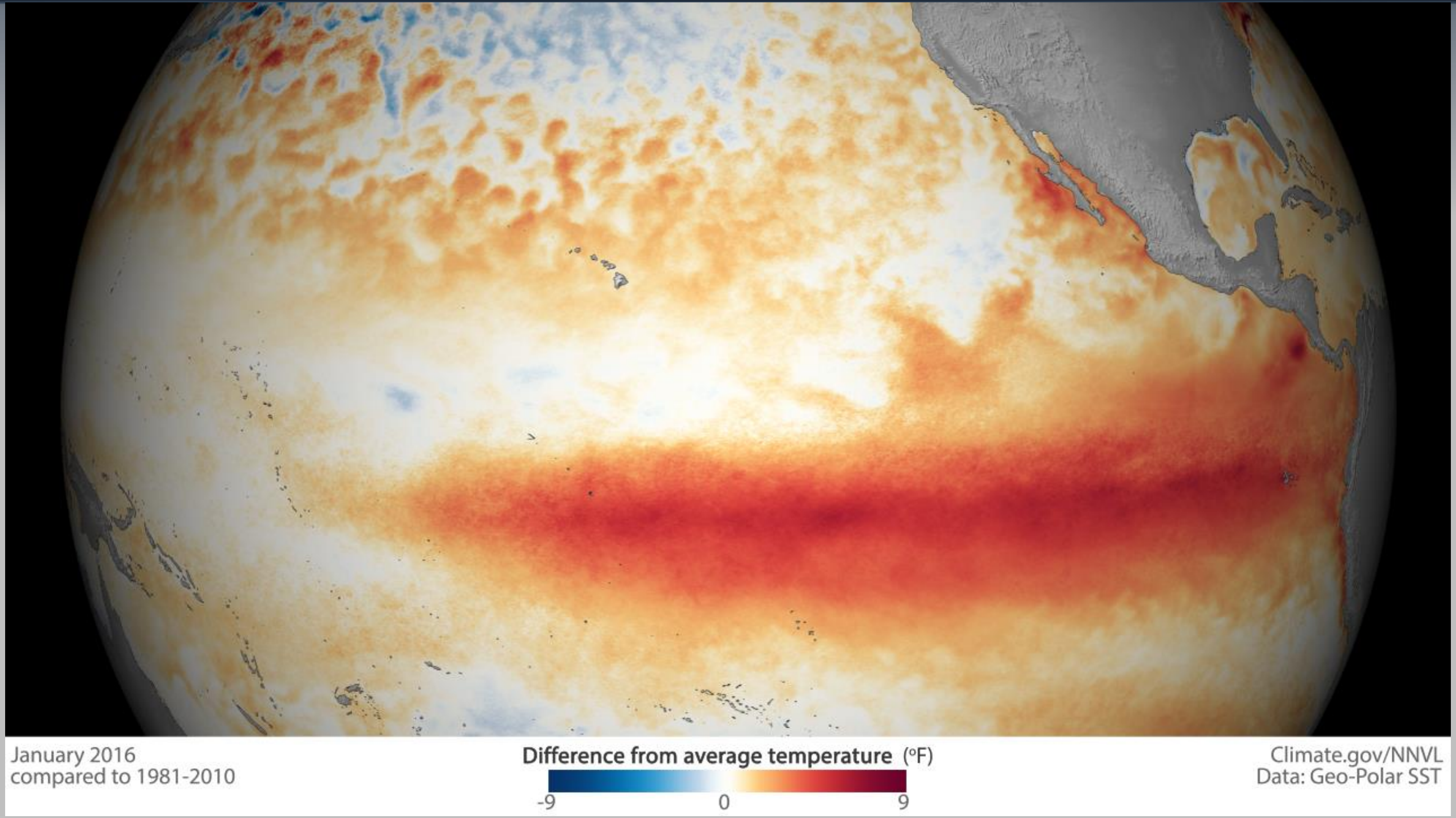
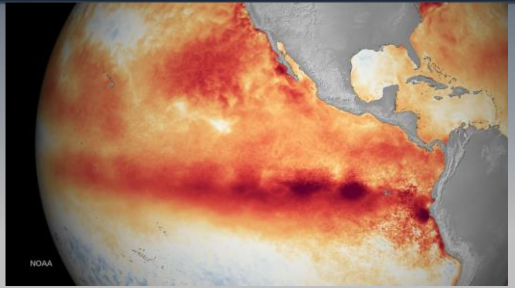
2016 Spring Outlook for Central & Northern New Mexico





High resolution map of sea surface temperature anomalies from January 2016 compared to late August/early September 2015 (upper right). This high-resolution map is based on a dataset that combines *in situ* measurements with near-real-time satellite observations. A map like this provides a detailed, up-to-date view of what oceans look like at any point in time, which is helpful for monitoring how an event is evolving and for providing starting data to initialize climate forecast models. What does a weakening El Niño have in store for New Mexico during Spring (March, April, May) 2016?

Latest Sea Surface Temperature Observations & Oscillation Index Values

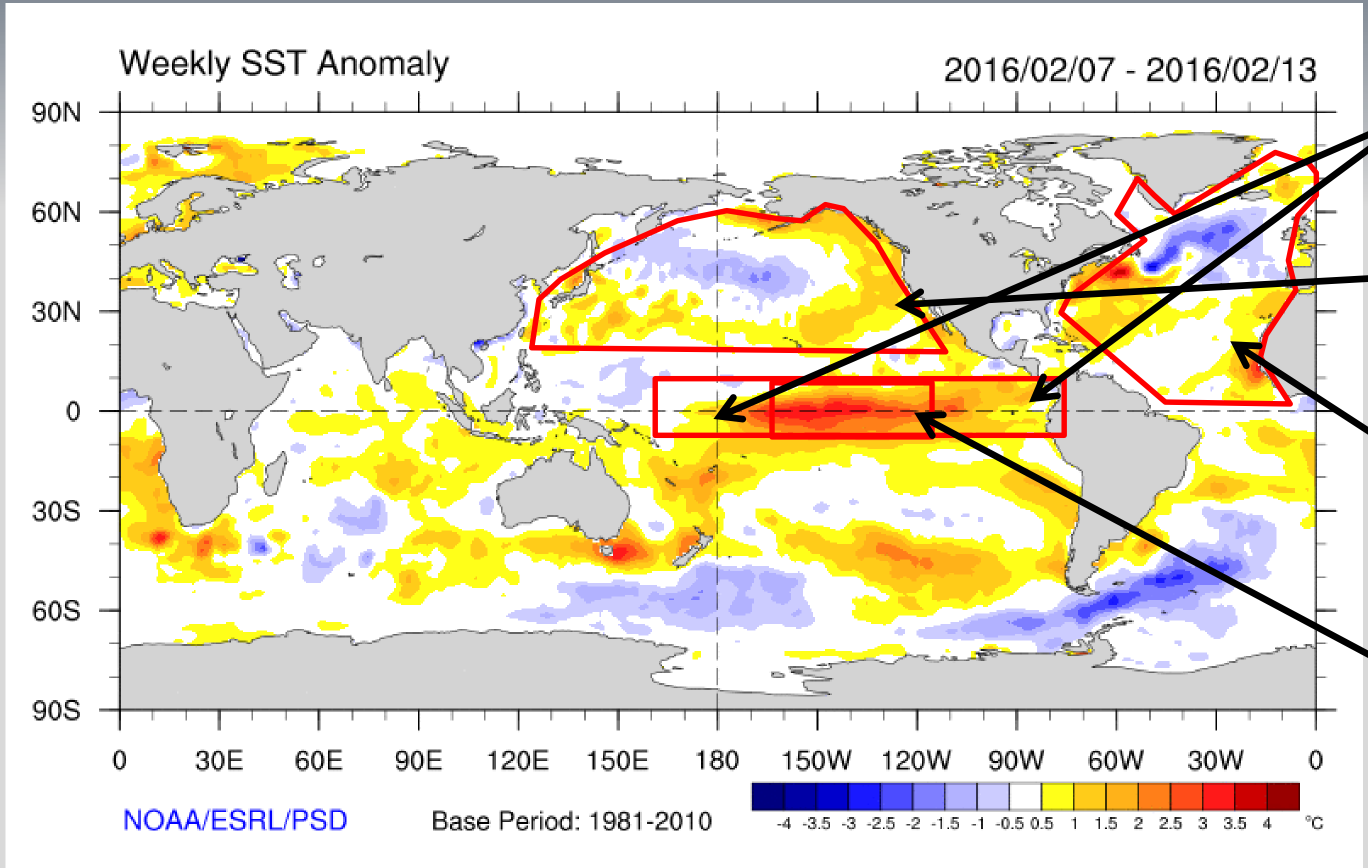


Figure 1. SST Anomalies in the Equatorial Pacific Ocean in early February 2016 showing a strong El Niño continues.

- Multivariate ENSO Index (MEI) for AUG-SEP 2015: +**2.53**
- Pacific Decadal Oscillation (PDO) for SEP 2015: +**1.94**
- Atlantic Multidecadal Oscillation (AMO) for SEP 2015: +**0.32**
- Oceanic Niño Index (ONI) (uses Niño 3.4 region - inner rectangle) for JAS 2015: +**1.5**

2015-16 El Niño vs. the Strongest El Niño events since 1950

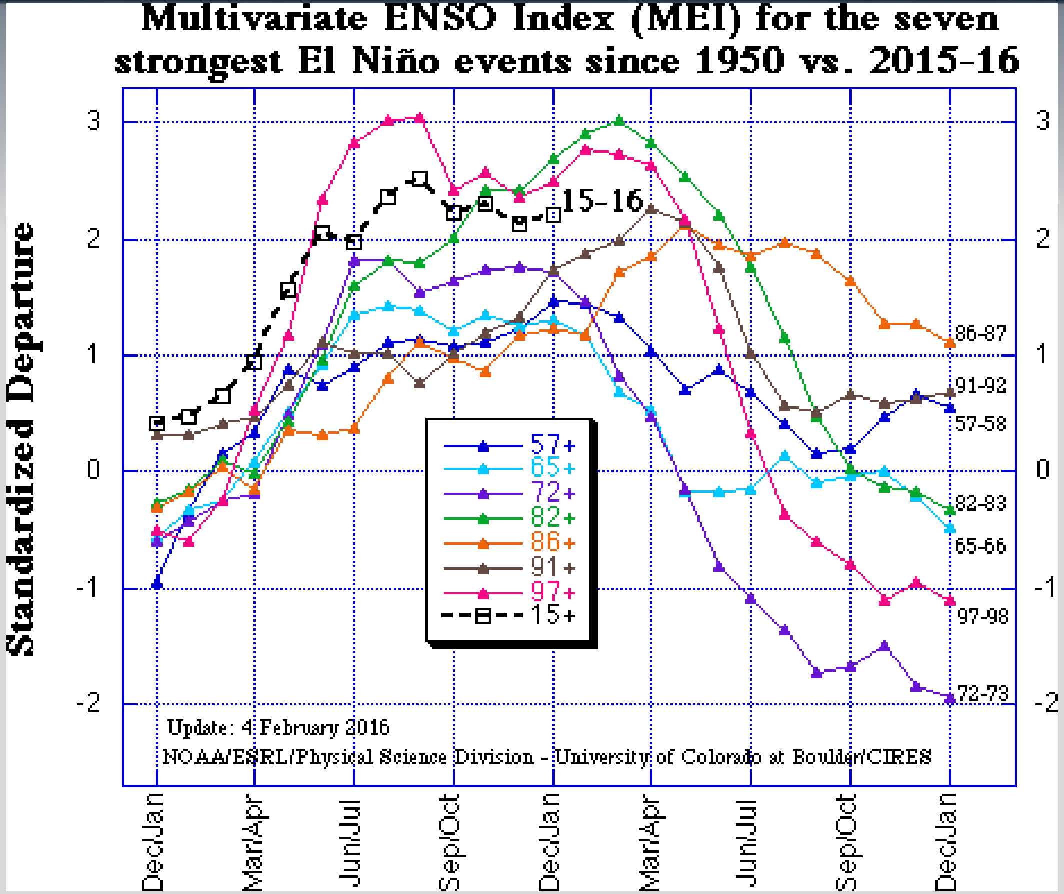


Figure 2. Seven strongest El Niño events using the Multivariate El Niño Southern Oscillation Index since 1950. 1957-58, 1972-73, 1982-83 and 1997-98 were chosen as analog years based on not only MEI values but also whether or not a positive Pacific Decadal Oscillation (PDO) was present.

So What if SSTs in the Eastern Pacific Ocean Are Warmer to Much Warmer Than Average?

Typical Jet Stream Pattern during La Niña

Typical Jet Stream Pattern during El Niño

Typical Tropical circulations during La Niña (Walker Circulation)

Typical Tropical circulations during El Niño (Walker Circulation)

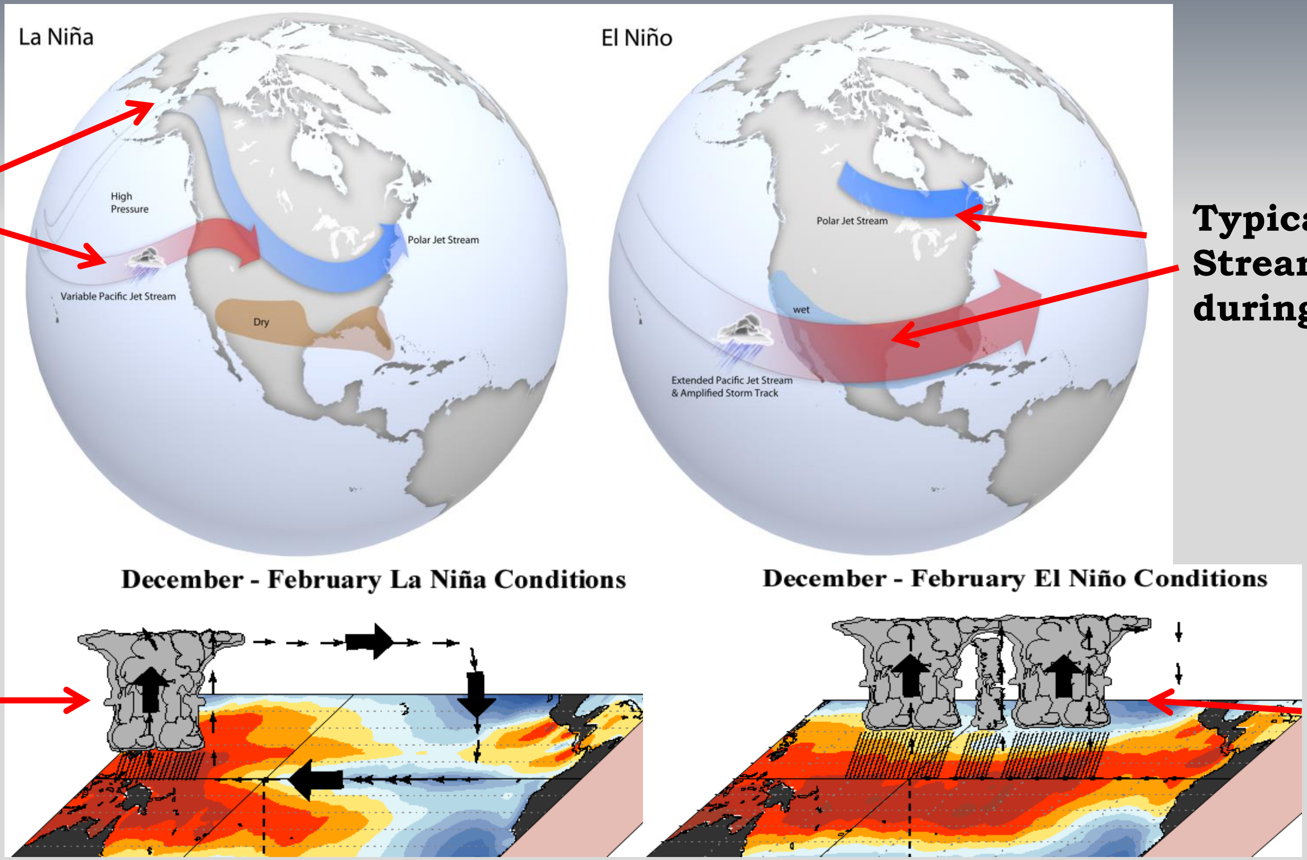
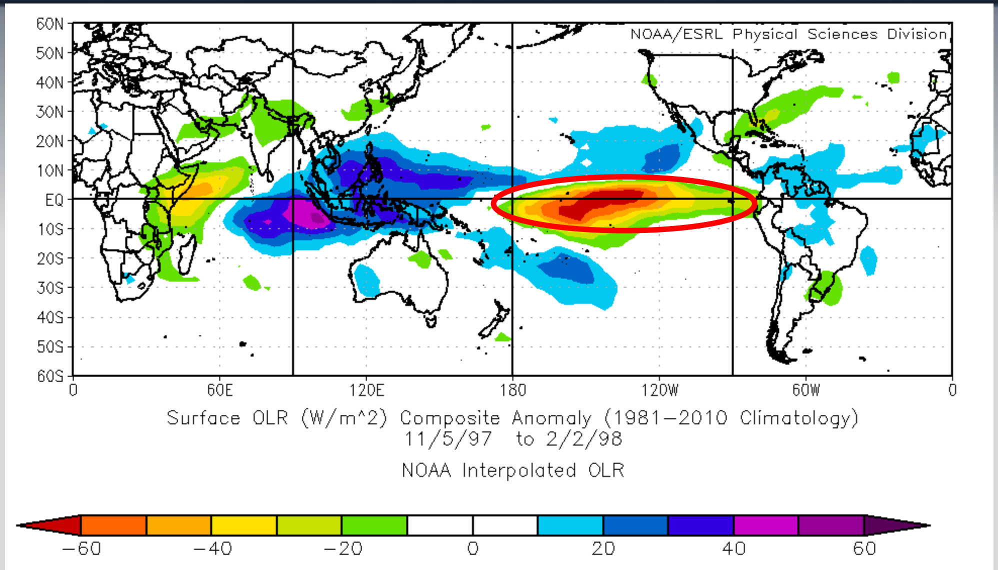
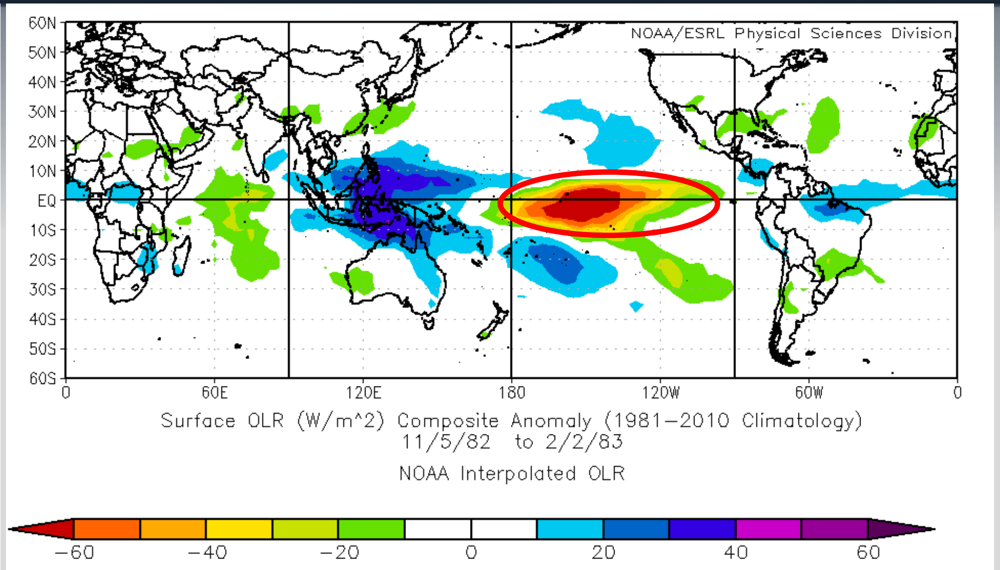


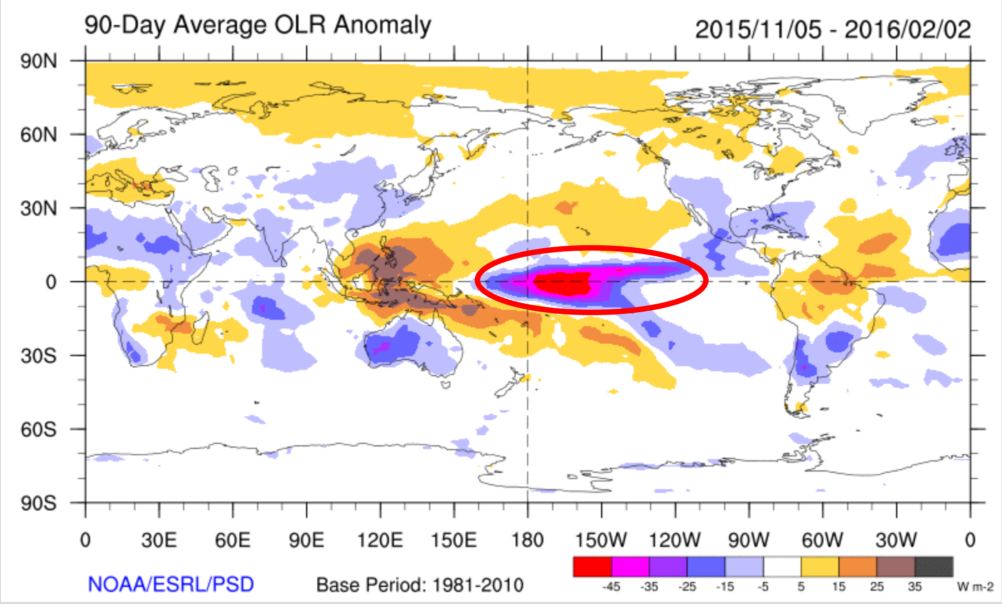
Figure 3. Warmer than average SSTs support stronger than average SST gradients across the Pacific Ocean and the resulting deep tropical and subtropical convection farther east than average. This deep convection allows the jet stream to penetrate farther east and southward into the far eastern Pacific Ocean and western United States. The jet stream is the result of large temperature differences between tropical and subtropical convection and much colder air aloft toward the poles. In other words, more deep convection farther east in the Pacific Ocean Basin typically equates to greater chances that the jet stream/storm track will move over New Mexico.

How This El Niño is Different from the 1982-83 & 1997-98 El Niño Events



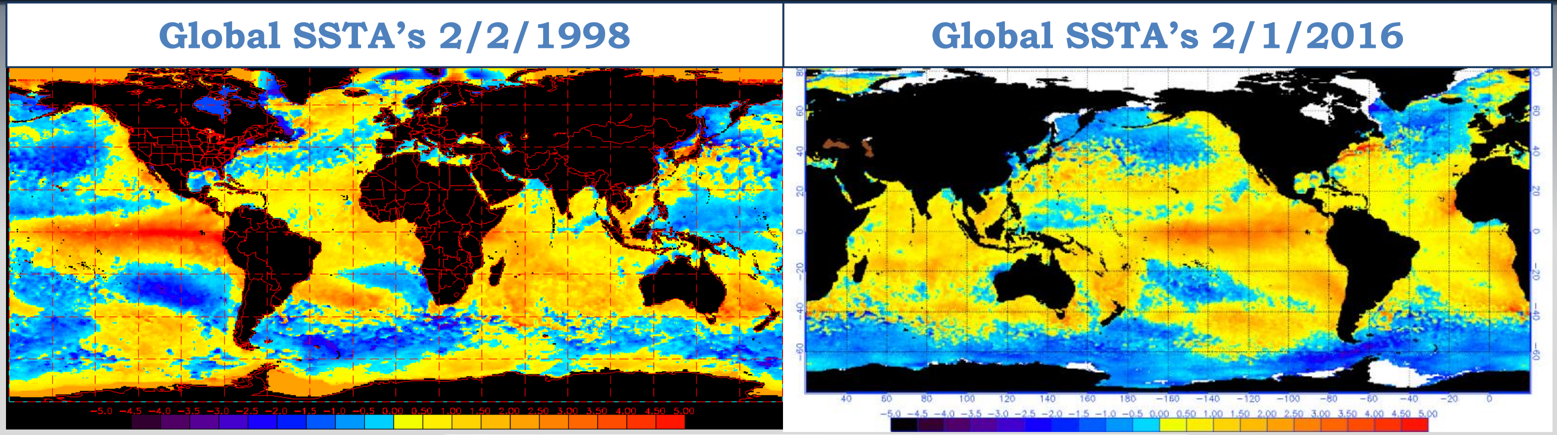


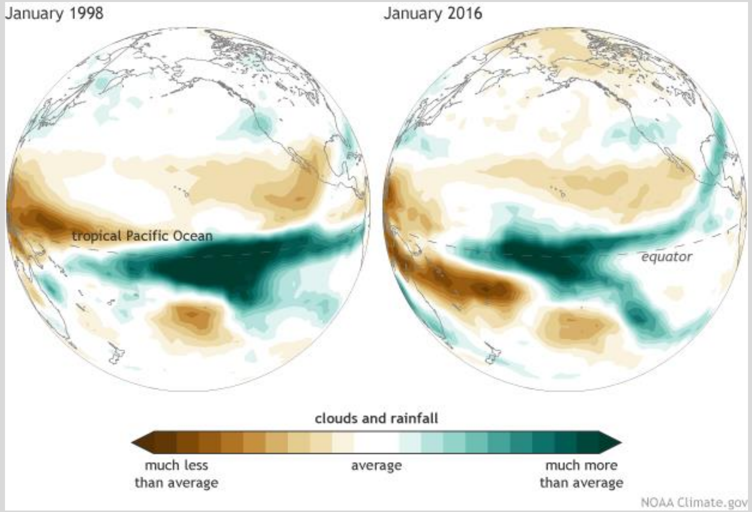
Figures 4-6. Outgoing Longwave Radiation (OLR) anomalies showing where anomalous convection was most common during the three strongest El Niño events since 1950. Deep tropical convection in the eastern Pacific during 1982-83 and 1997-98 was farther east than in 2015-16 to date. The anomalous convection associated with El Niño determines where the jet stream shifts south.



Since about mid January 2016, the jet stream has been dipping farther south across the eastern Pacific Ocean instead of across the Southwest U.S. The next two slides will provide an insight as to why this is likely occurring.

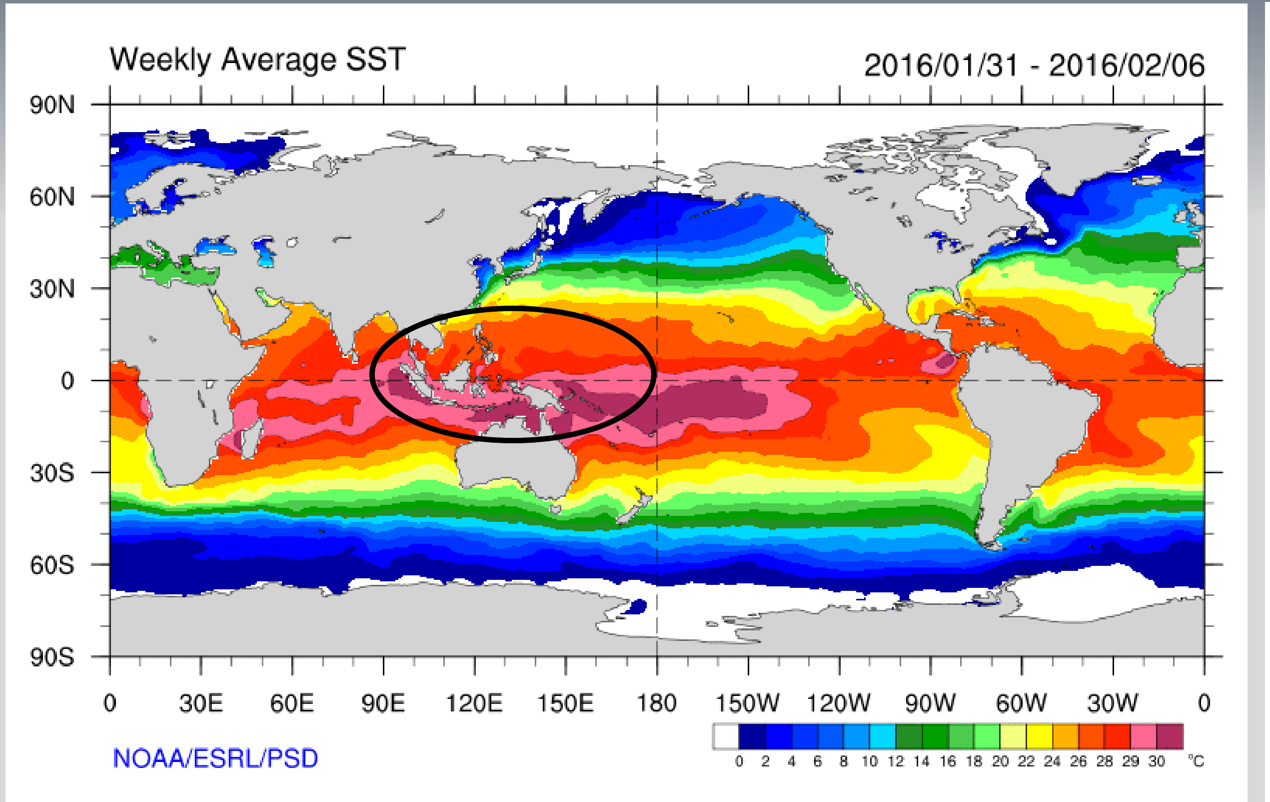
Comparing early February 1998 Global SSTAs to early February 2016

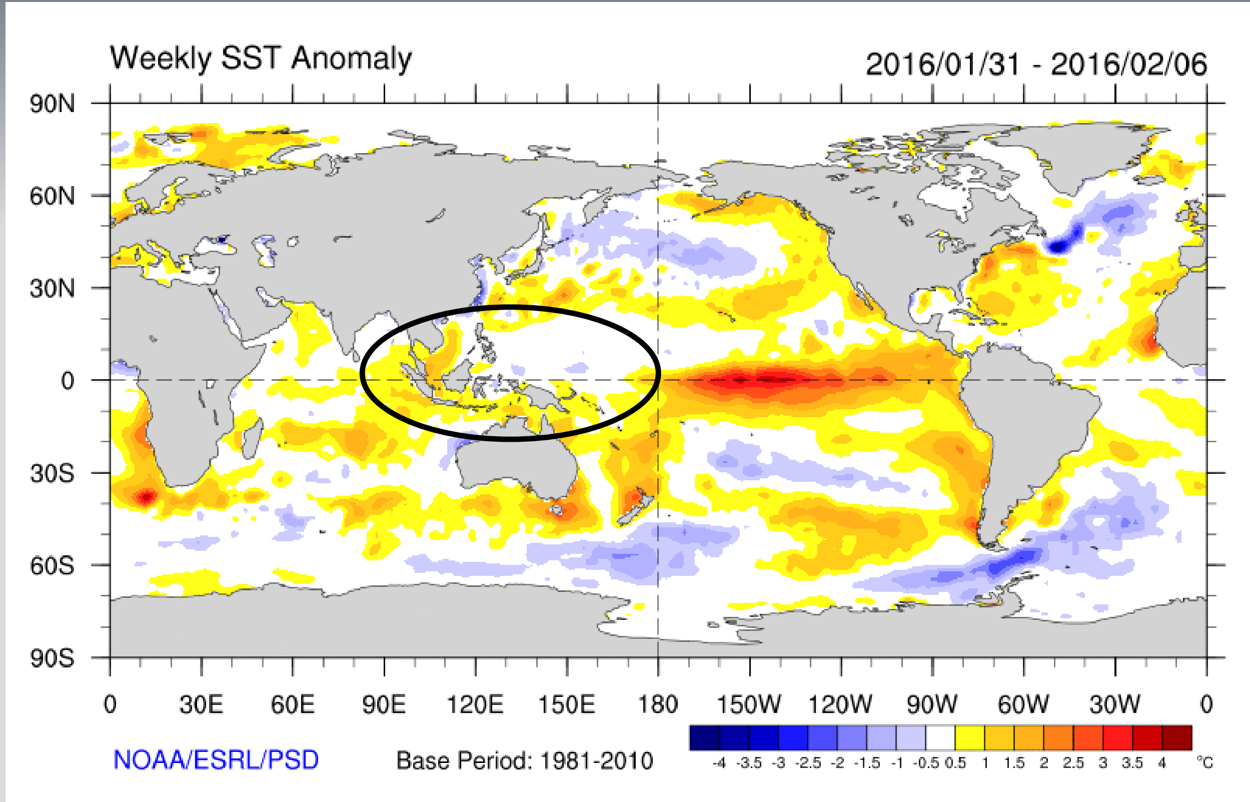




Figures 7-9. SSTAs from one of the closest analog years, 1998, and current conditions. Note stark the differences between SST gradients between the eastern and western Pacific Ocean in 1998 and 2016. Convection across the eastern Pacific Ocean during DJF 2015-16 was below 1982-83 and 1997-98 activity, in part due to the lack strong SST gradients. Also note the map projection difference. Bottom image: clouds/convection during January 1998 (left) and January 2016 (right). Clouds can be detected by satellites because they block the amount of longwave radiation leaving the earth's surface (OLR).

Importance of SST Gradients





Figures 10-11. SSTs and SST Anomalies from early February 2016. Why has the convection associated with this El Niño been farther west than past similar events? Stronger SST gradients between the western and eastern Pacific Ocean produce stronger winds blowing across the equatorial Pacific. A weaker gradient results in weaker winds and vice-versa: stronger winds can lead to stronger SST gradients and weaker winds contribute to weaker SST gradients. Strong west to east SST gradients can also lead to surface convergence and thunderstorm development farther east than average. The difference between the warmer than average SSTs in the eastern Pacific Ocean and the near average SSTs in the western Pacific during the 2015-16 El Niño event has been weaker compared with past events (Figures 7-8).

MAM Snowfall – Analog Years vs. 30-yr Averages

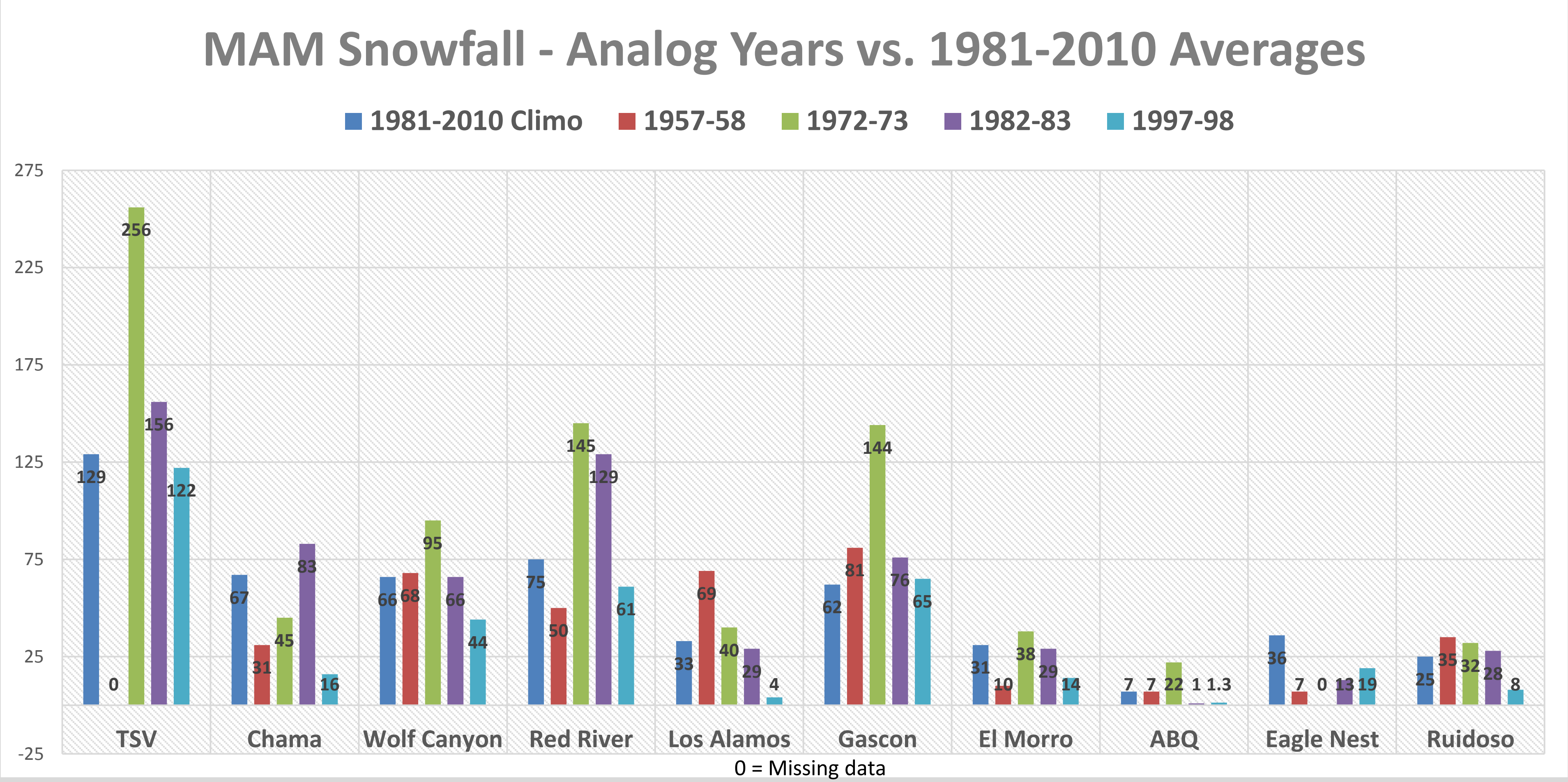


Figure 12. MAM snowfall from selected sites comparing very strong-extreme El Niño events with 1981-2010 climatological averages. Higher elevation sites received near to well above average snowfall whereas lower elevations sites varied considerably from one very strong-extreme El Niño to the next. Taos Ski Valley (TSV) had its snowiest winter and spring seasons on record during the very strong El Niño of 1972-73.

MAM Precipitation – Analog Years vs. 30-yr Average

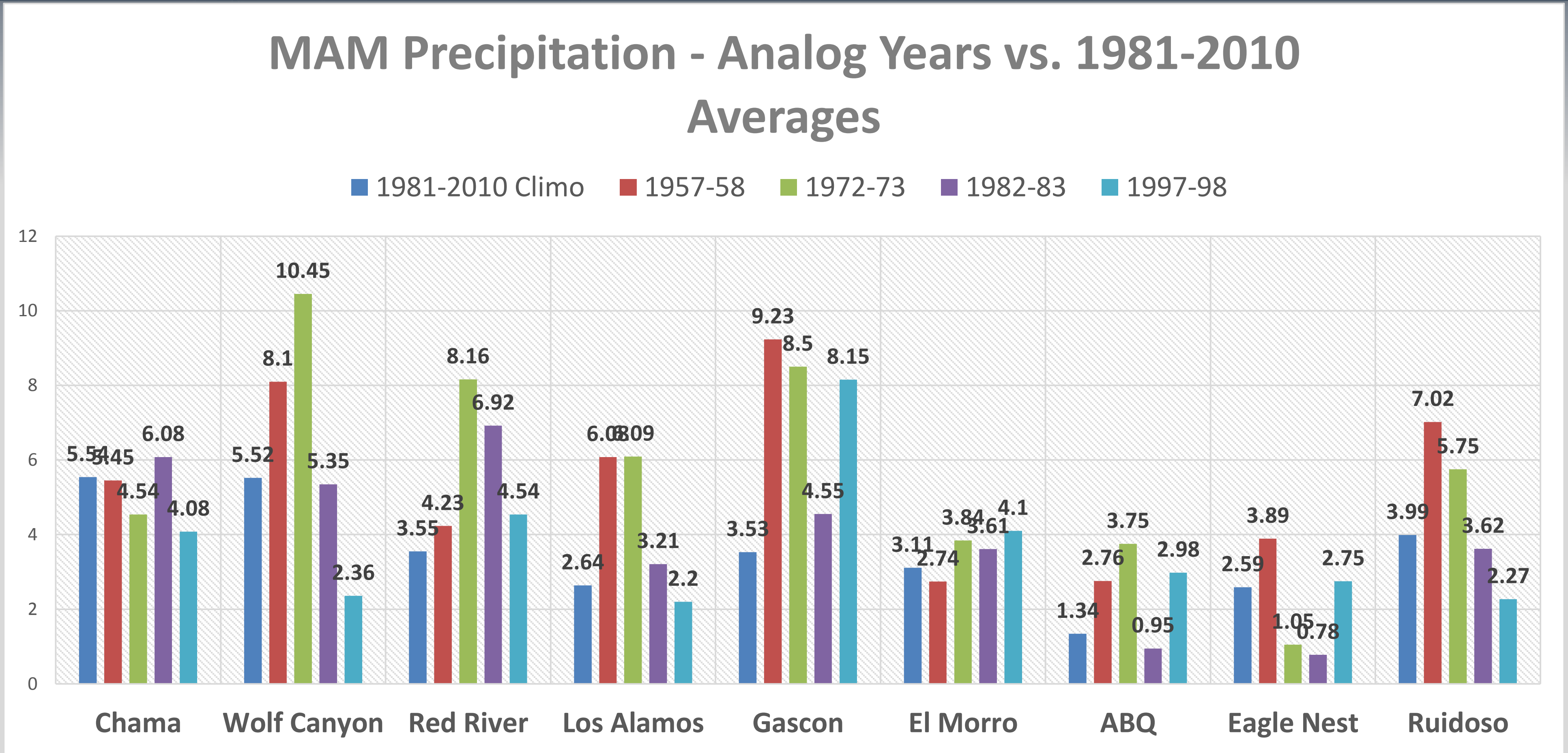


Figure 13. MAM precipitation from selected sites comparing very strong-extreme El Niño years to the 1981-2010 climatological average. Above to well above average precipitation fell at most sites during meteorological spring (MAM) during very strong to extreme El Niño events.

MAM Temperatures – Analog Years vs. 30-yr Averages

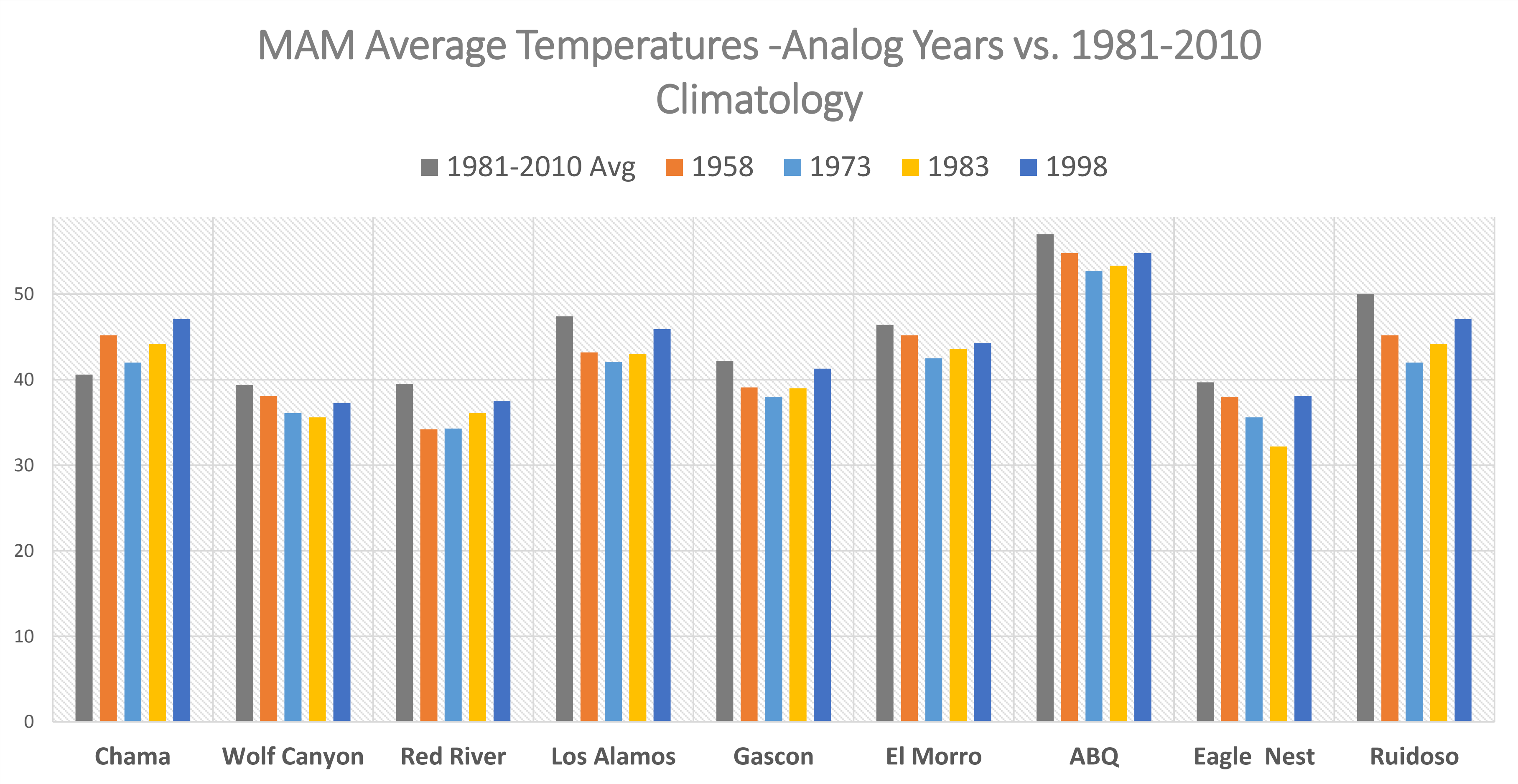
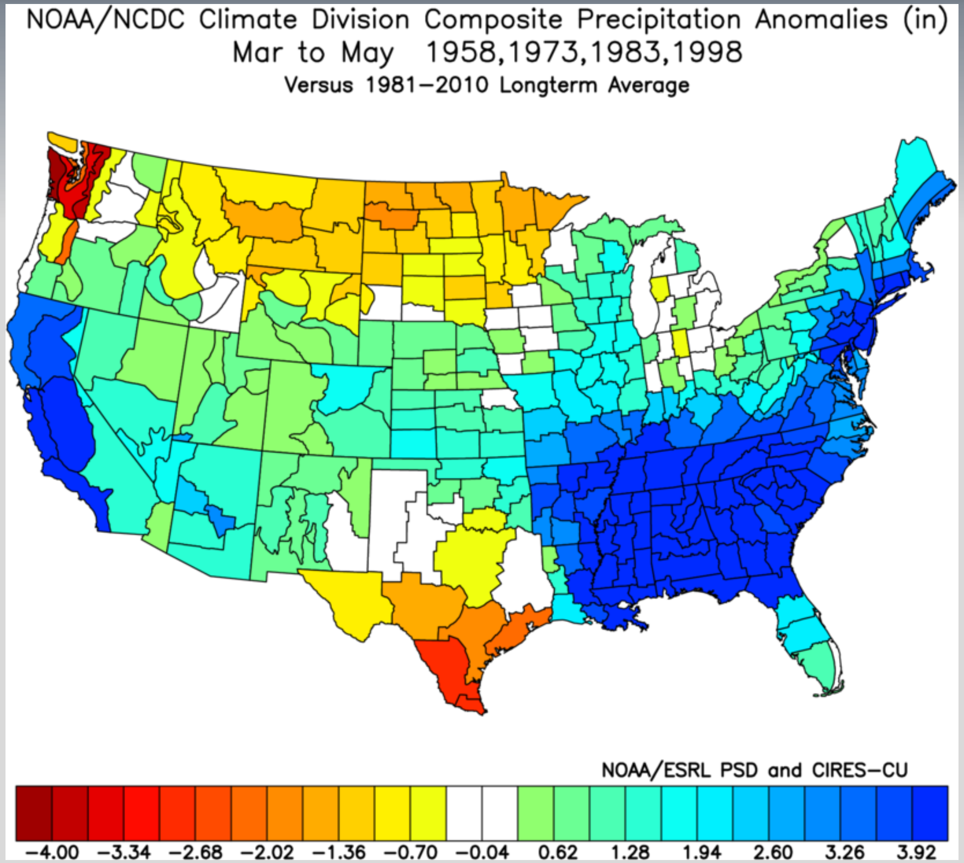
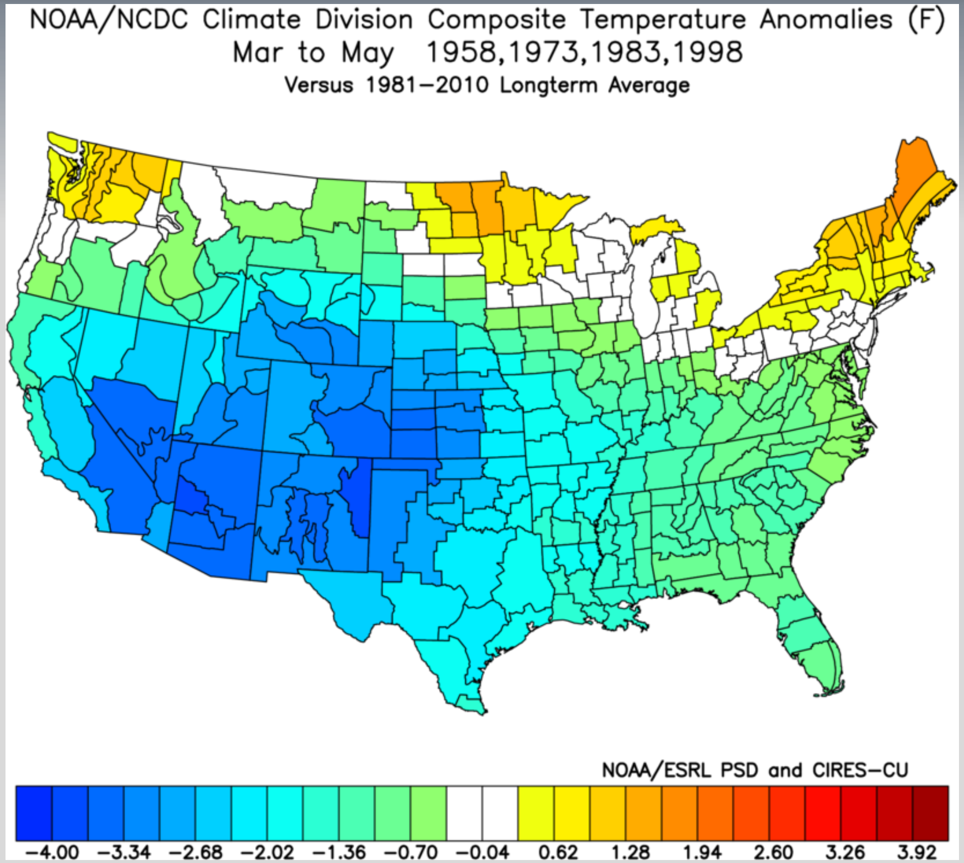


Figure 14. MAM average temperatures from selected sites comparing very strong to extreme El Niño years to 1981-2010 climatological averages. Average temperatures at all sites with the exception of Chama were below 30-yr averages during meteorological spring (MAM) during very strong to extreme El Niño events.

MAM Precipitation & Temperature Anomalies





Figures 15-16. MAM Precipitation and Temperature anomaly plots for CPC's climate divisions comparing the four strong/extreme El Niño years (1957-58, 1972-73, 1982-83 & 1997-98) with 30-year climatological averages. Seven of the eight climate divisions in the state were slightly above average for precipitation while all climate divisions were below to well below average with regard to temperature.

Latest Climate Model Forecasts

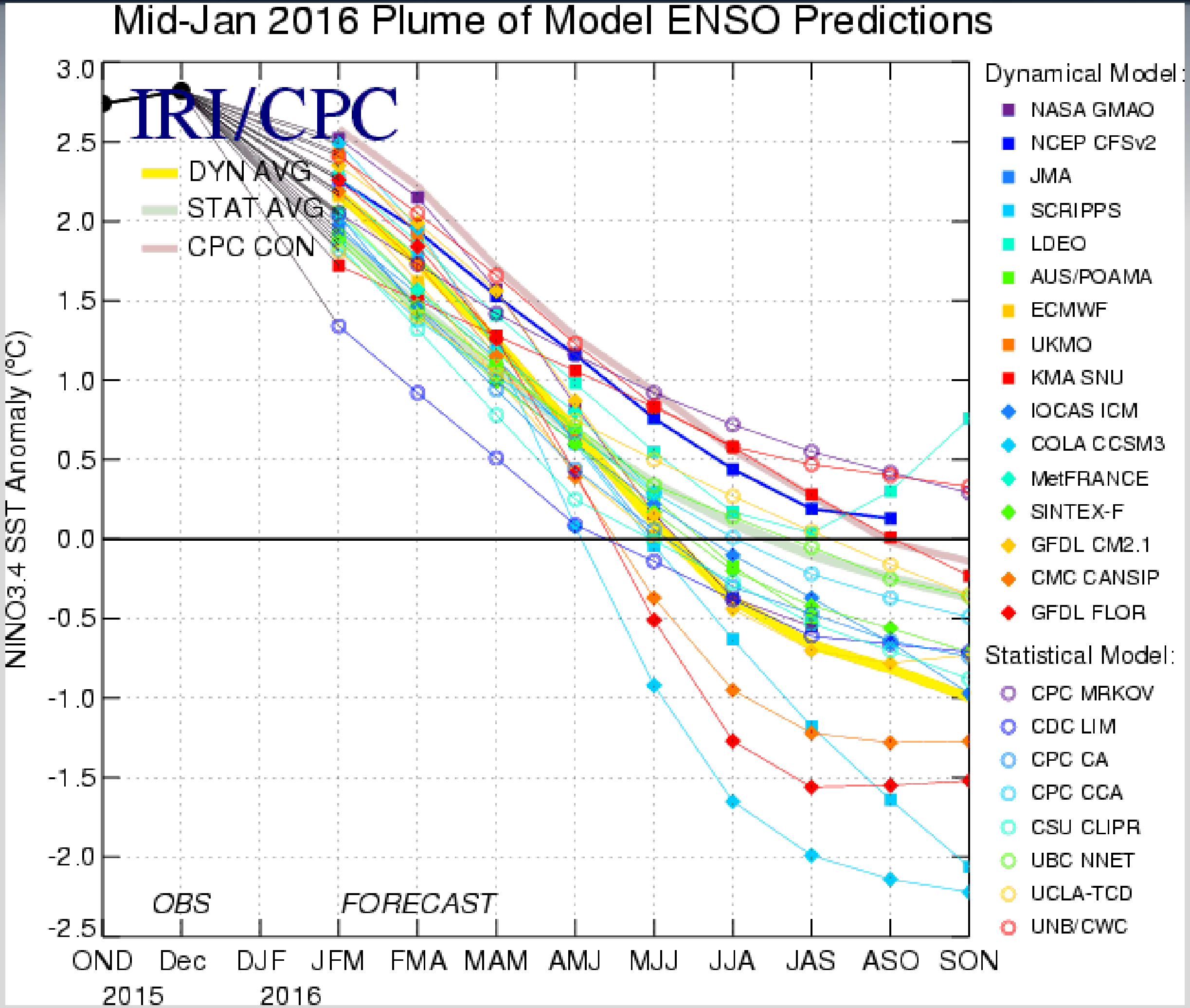
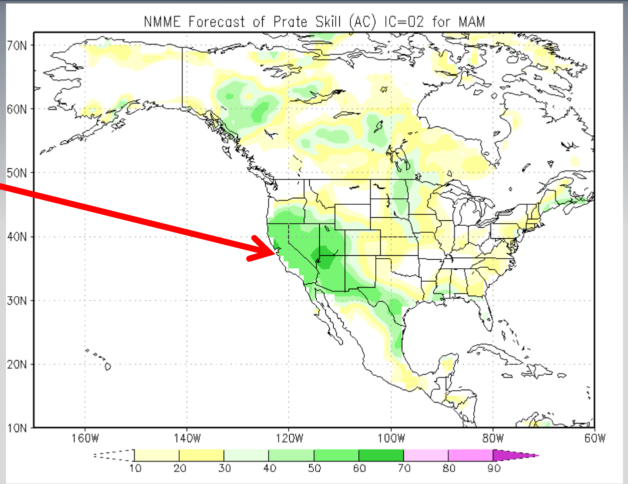
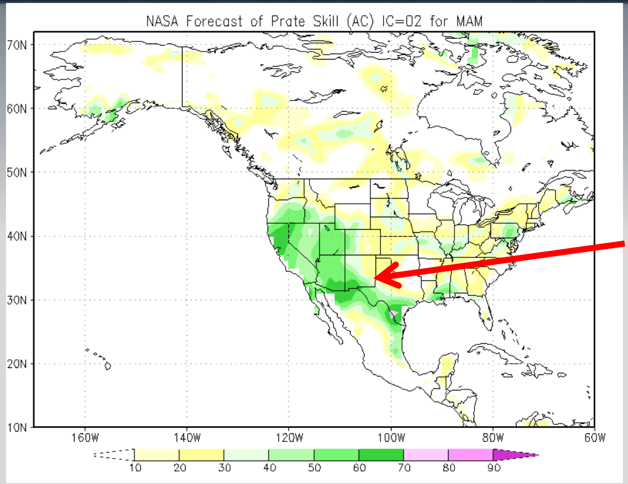


Figure 17. El Niño is predicted to weaken during MAM. Most models suggest a transition to ENSO-neutral by May-June-July (MJJ) 2016.

Numerical Climate Prediction Model Output for MAM

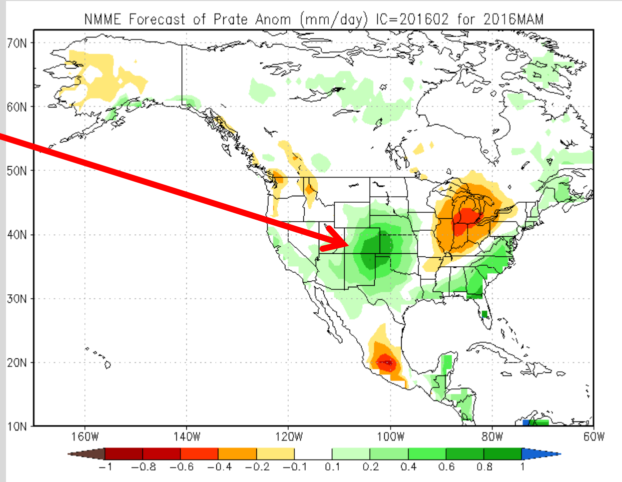
Highest model skill in MAM over AZ/CA and across the Great Basin.

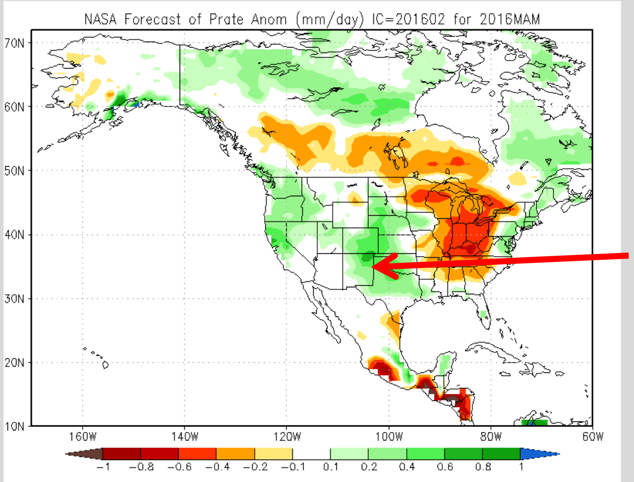




Highest model skill in MAM over southwest NM, AZ and Great Basin.

Green equates to above to well above average precipitation rates.

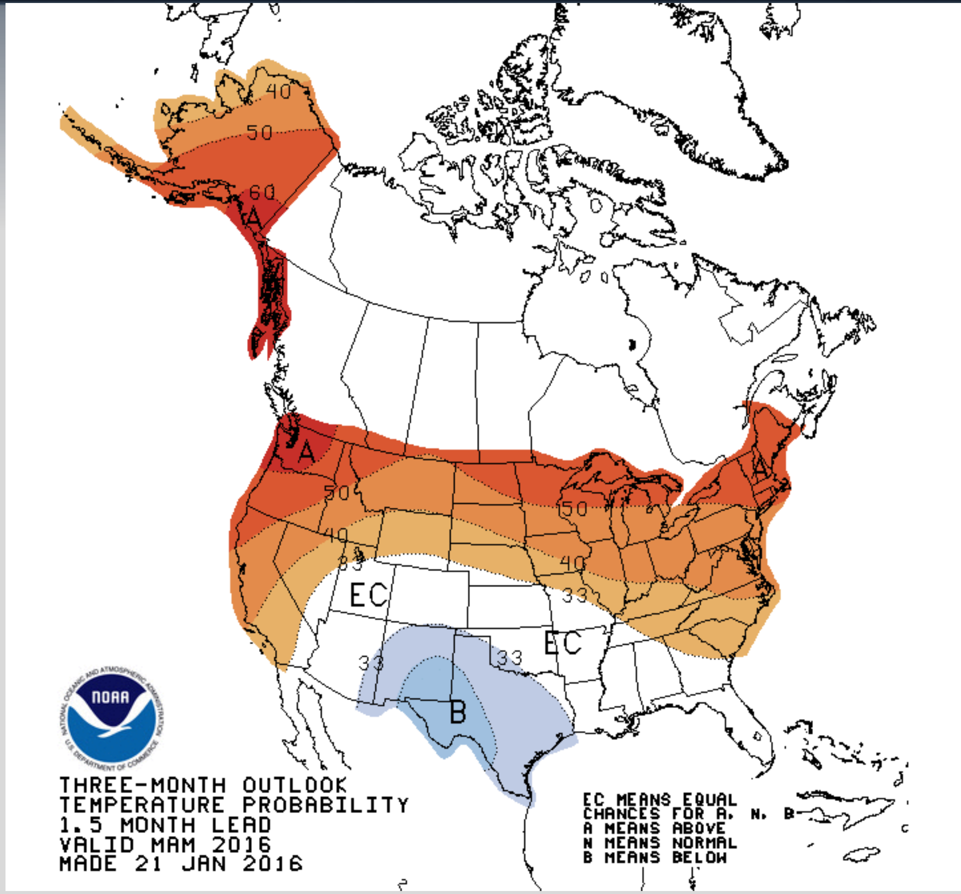


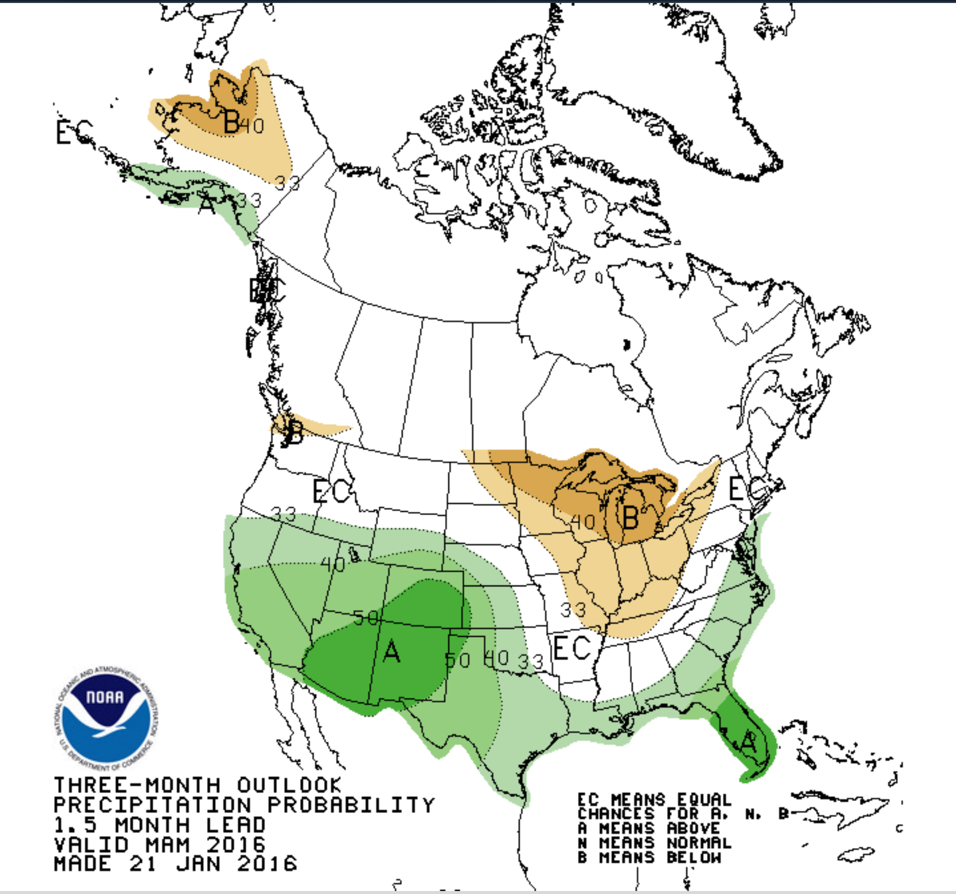


Light Green to Green equates to slightly above to above average precipitation rates.

Figures 18-21. Model precipitation rate anomaly plots from the two climate models which have the highest skill percentages (top two images), the North American Multi-Model Ensemble (NMME) and the NASA models. Both model forecasts range from slightly above average to well above average precipitation rates during MAM 2016 across New Mexico.

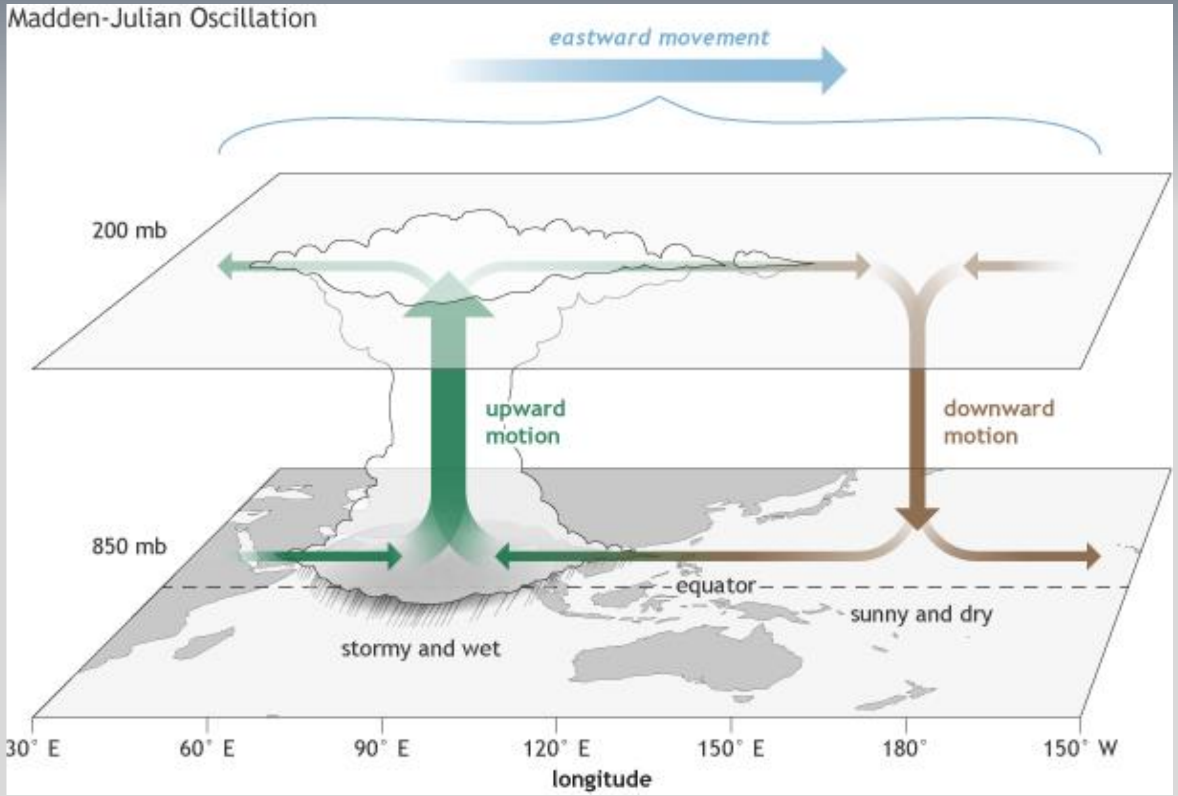
Climate Prediction Center's Official MAM Outlook

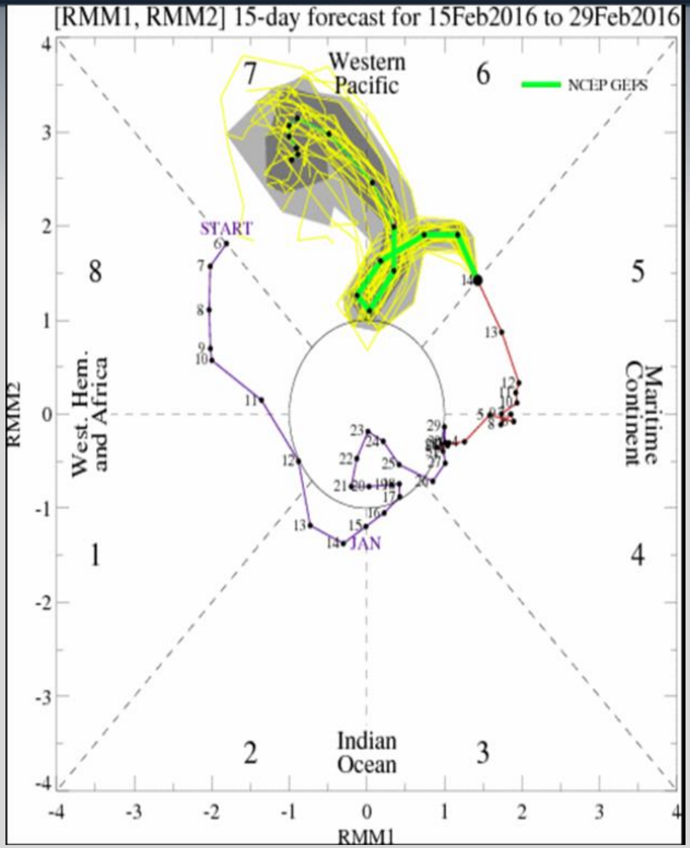




Figures 22-23. CPC's MAM 2016 precipitation and temperature forecasts favoring above average precipitation and greater than average chances for temperatures to be slightly below average across much of New Mexico.

Madden-Julian Oscillation (MJO)





Figures 24-25. The MJO is an area of enhanced thunderstorms that travels around the world every 30 to 60 days from west to east along/near the equator. Ahead and behind the active stormy area are areas of suppressed convection and drier conditions. The MJO affects near-surface wind patterns, because the rising air in the stormy area causes surface winds to blow toward the active area. It is possible that when the MJO related circulation (left) will enhance convection across the eastern Pacific Ocean in early to mid March, helping to draw the jet stream farther south across the Southwest U.S.

How About Wind?

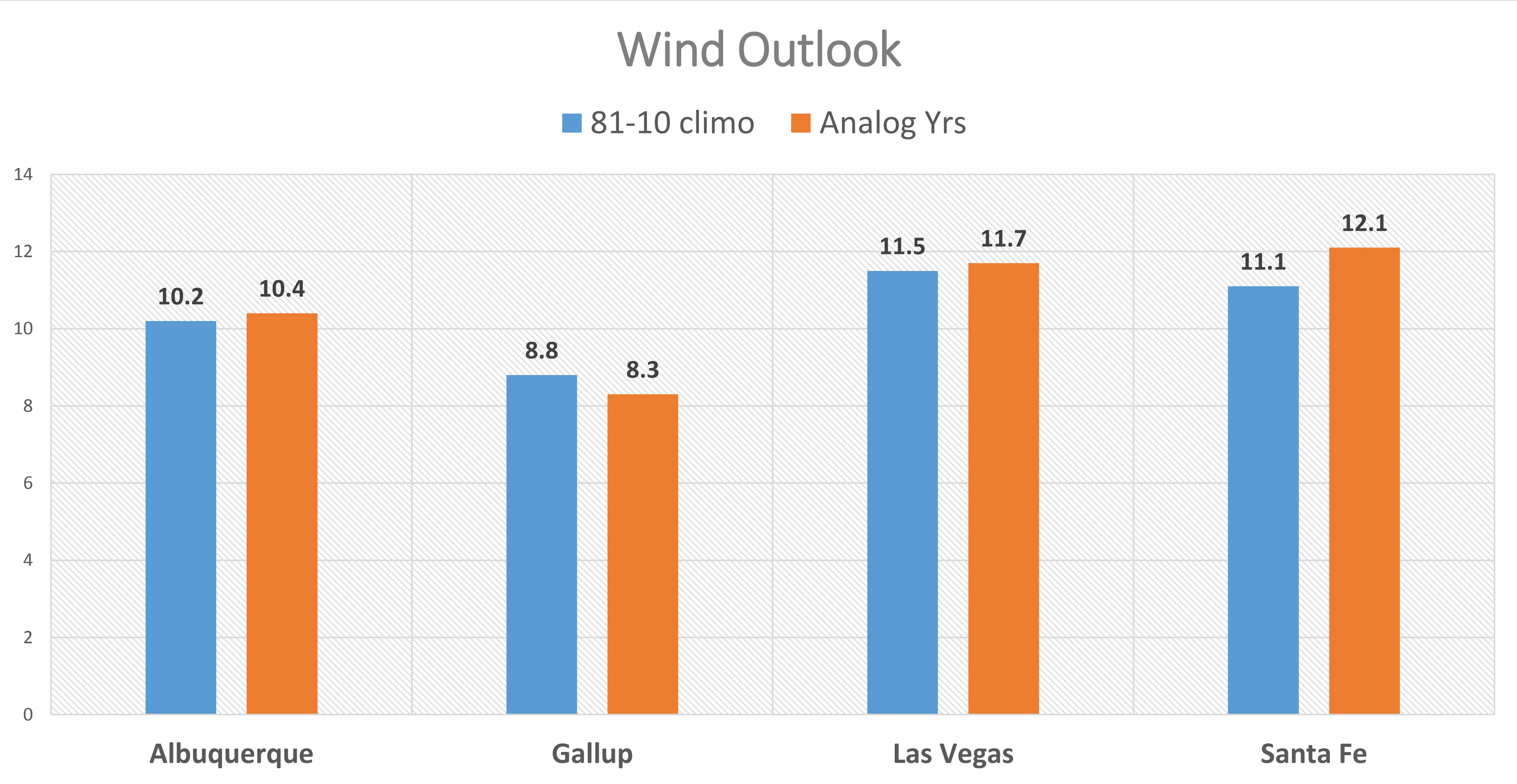


Figure 26. Hourly average wind speeds during analog years were near 1981-2010 climatological averages for MAM.

A Peak at Ahead- Relationship Between El Niño and La Niña

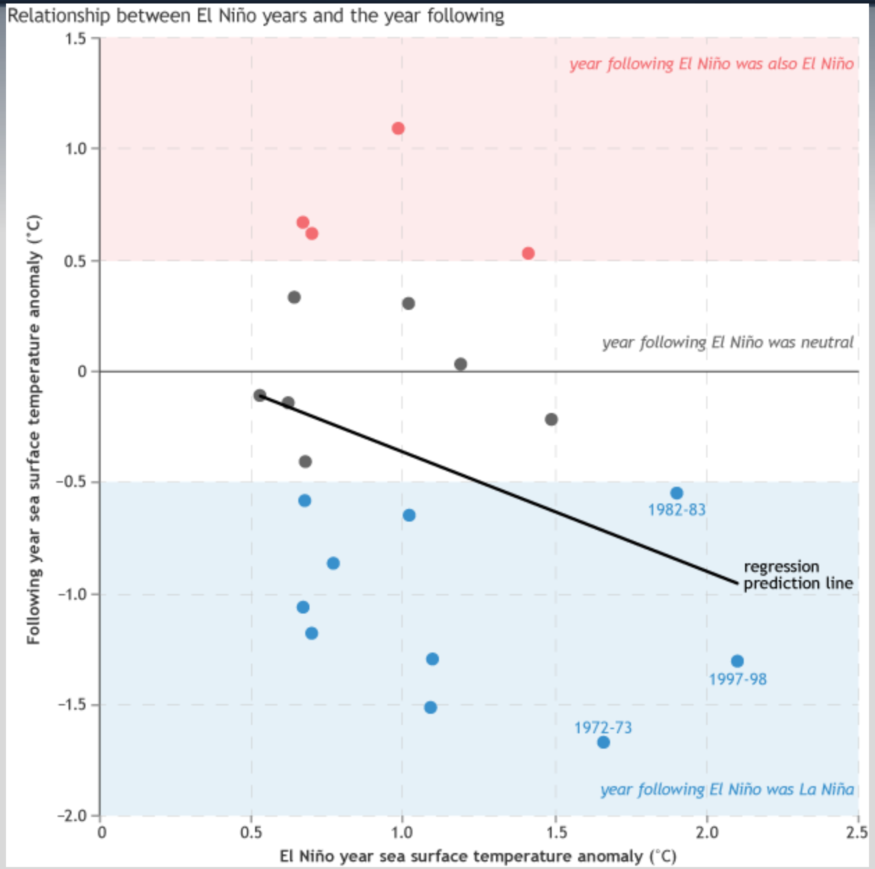


Figure 27. Scatterplot showing the relationship between the ENSO state (using the 6-running-season ONI definition) for years having an El Niño (x-axis), and the ENSO state the following year. Each dot represents one pair of "year 1 vs. year 2" ENSO states for El Niño events observed since 1950. The downward sloping line is a linear regression fit to the data points. The probability of getting La Niña for 2016-17 is 66%, leaving a 34% chance for falling short of the La Niña threshold.

Summary

- Precipitation (both rain and snow) in previous Spring (MAM) seasons during strong to extreme El Niño events since 1950 ranged from above to well above the 1981-2010 climatological averages at sites throughout northern and central New Mexico. March precipitation, in particular, was above to well above average in all analog years at all sites.

- Precipitation data from the four most analogous years to 2016 (1957-58, 1972-73, 1982-83, and 1997-98) combined with forecasts from the most highly skilled climate forecast models indicate that precipitation in central and northern New Mexico during March, April and May 2016 will most likely range from slightly above to above 1981-2010 climatological averages.

- Snowfall data from the four previous strong to extreme El Niño events combined with climate model forecasts suggest that snowfall will range from slightly above to above average in MAM 2015-16.

- Temperature data from the four most analogous years to 2016 combined with climate model forecasts indicate that temperatures in central and northern New Mexico during MAM 2016 will mostly likely range from slightly below to below 1981-2010 climatological averages.

- Keep in mind that long dry periods during super or extreme El Niño events were observed in the past and that a super/extreme El Niño does not usually equate to well above precipitation. The highest precipitation anomalies in the northern two-thirds of the state are associated with moderate El Niño events.

Outlook Information

- **Outlook provided by National Weather Service Forecast Office Albuquerque, NM.**

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